The MAC Flyer

MAY 1976

When Fuel Gets Low..Page 22.

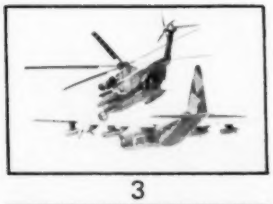
MILITARY AIRLIFT COMMAND
GEN PAUL K. CARLTON Commander
LT GEN JOHN F. GONGE Vice Commander
BRIG GEN EDWARD J. NASH Inspector General
COL EMERY J. CRANE Director of Safety

The MAC Flyer

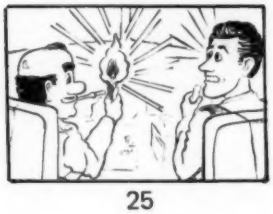
For Greater Efficiency
in MAC Air Operations

THE STAFF
LT COL JOHN W. RAY Supervising Editor
MAJ ORLEN L. BROWNFIELD Associate Editor
CAPT BRUCE L. GUMBLE Associate Editor
ISOBEL M. BRYANT Managing Editor
BRIAN L. GAUSS Art Director

MAY 1976 MACRP 127-5 VOL XXIII, NO. 5


3

18


25

The Primary Responsibility 3
That's My Mom 6
Mishap with a Moral 8
Autorotation 11
Global Notes 15
1975 MAC Safety Award Winners 16
Return to Tweety 18
Down 21
Where To Go When Fuel Gets Low 22
C. R. Terror 25
Quick Stoppers 28

THE MAC FLYER is published by the Directorate of Safety, Headquarters Military Airlift Command. The contents are informative and not regulatory or directive. All names in accident stories are fictitious and no information concerning aircraft accidents may be construed as incriminating under Article 31, UCMJ.

Contributions, comments, and criticisms are welcome. Write: The Editor, THE MAC FLYER, MAC/IGFE, Scott AFB, IL 62225, or call: (618) 256-3534, Autovon 638-3534. The editor reserves the right to change manuscripts to improve them or correct technical errors.

The magazine is available from: The Superintendent of Documents, Government Printing Office, Washington, DC 20402. Price 70 cents per copy, $7.90 per year ($9.90 foreign).

Distribution F, X; OPR MAC/IGFE.

The Primary Responsibility

Honorable Mention
1975 MAC Flying Safety Writing Contest

by Capt Gregory L. Walts
1551 FTS
Kirtland AFB, N.M.

The jangling telephone shattered his deep slumber. As he picked up the phone, ghostly figures on the luminous clock caught his eye. Two o'clock.

"Lieutenant Peters, this is the Rescue Coordination Center. We have a scramble mission for your crew. Report to the operations section as soon as possible," directed the somber-voiced caller.

Fumbling around his dark bedroom, he managed to put on his flight suit and flying boots. His mind quickly stepped into high gear. Briefly, he thought of his recent upgrade and the long, hard flying hours practicing intricate search and rescue maneuvers. He recalled his certification board, completed less than 48 hours earlier, and his commander's words on responsibility. "The primary responsibility of an aircraft commander is for the safety of his crew and his aircraft regardless of the importance of the mission."

Driving to the squadron, he wondered about the mission that caused the scramble. He smiled. He knew that he was one of the youngest pilots to upgrade to aircraft commander. That old HC-130 flew just like it should when he was at the controls. It didn't matter what the mission was; he could hack it. No sweat.

The mission coordinator patiently waited to brief the crew members. Seated in the front, Lieutenant Peters noticed that the squadron's HH-53 alert crew was now arriving. The aircraft commander, Major Hawkins, an old pilot with over 5,000 hours in helicopters, gathered more details over the phone. Finally, the mission coordinator briefed both crews on their mission. A navy destroyer nearly 500 miles out to sea had requested an immediate medevac of a crew member who was suffering from acute appendicitis. Flying an HH-53, Major Hawkins would make the pickup, with escort and aerial refueling provided by Lieutenant Peters' HC-130.

At the conclusion of the briefing, the two pilots ironed out last minute refueling and escort details prior to mission launch. Major Hawkins eyed the lieutenant cautiously. He was apprehensive about the young aircraft commander, but then again, he was impressed by the way Lieutenant Peters intelligently discussed the mission ahead.

Less than forty-five minutes later, both crews had engines running on their respective aircraft. Major Hawkins quickly taxied the Super Jolly Green Giant to the helipad as Lieutenant Peters finished engine runup checks on his Herky Bird. All preflight checks completed, the HH-53 lifted off, completed its hover checks, and departed on its initial heading seaward. Lieutenant Peters watched the chopper fade away into the horizon. Finally, Air Force Rescue 60221 was cleared

The rendezvous and joinup went like clockwork

for takeoff. As Lieutenant Peters pushed the throttles forward, perspiration beaded his forehead. The HC-130 rambled down the runway and the copilot commanded, "Go!" When the new AC called, "Gear up," a peculiar sensation pulsed throughout his body. He was now airborne on his first mission as an aircraft commander.

Leveling off the HC-130 at 8,000 feet, Lieutenant Peters positioned his Hercules slightly behind and 1,000 feet above Major Hawkins' Super Jolly. He stared at the lonely rotating beacon on the helicopter and thought of the manuevers that would be required later in the mission. He appreciated the tropical Pacific base where he was stationed and its excellent weather conditions. Tonight was no exception.

The two Rescue aircraft soon settled into an almost boring routine of position reports and updates on the ship's position and the patient's status. Occasional heading corrections directed by the navigator and messages from the Rescue Coordination Center kept monotony at bay. The engineer mentioned something about a fuel chart which alerted Lieutenant Peters to the fact that an aerial refueling would be due shortly.

As per mission plan, the first aerial refueling was scheduled for two hours after takeoff. This would insure sufficient fuel for the chopper to rendezvous with the destroyer or, if the aerial refueling could not be completed, it would still have enough fuel to return to the base. Minutes later Lieutenant Peters alerted his crew to prepare for aerial refueling and directed all crew members to put on their LPU's and parachutes. The rendezvous and joinup with the Jolly Green went like clockwork, just as it had during training. In the observation position, the thirsty helicopter awaited the slowly extending refueling hoses. Lieutenant Peters cleared Major Hawkins to take on 4,000 pounds of fuel from the left drogue. Seemingly hovering at 110 KIAS, the HC-130 was a steady refueling platform, making it easy for Major Hawkins to plug in to the refueling drogue. Minutes later the refueling was complete and the drogue retracted into the refueling pods. Lieutenant Peters' confidence blossomed.

At sunrise, the Hercules crew spotted the destroyer on the horizon. The two rescue aircraft quickly closed the gap and Major Hawkins circled the ship to select a suitable spot to hoist the patient aboard. The stern appeared to be the best spot and Major Hawkins coordinated and relayed instructions to the destroyer's captain.

While the destroyer altered course 30 degrees into the wind, Major Hawkins decided to take on more fuel from the HC-130 prior to the rescue. The second aerial refueling was completed just as quickly and efficiently as the first.

As Lieutenant Peters circled overhead, Major Hawkins slowly approached the stern of the destroyer and settled into a hover. Working together, the flight mechanic and PJ lowered the Stokes litter to the deck of the pitching, rolling destroyer. Navy personnel quickly secured the patient into the litter and signaled the Jolly Green crew to hoist away. The pickup lasted only 30 minutes. Once the patient was aboard, Major Hawkins departed toward home base.

Flying in loose formation, the two Rescue aircraft returned to the routine of en route flying. The mission looked like it would merit a "save" as the flight surgeon in the helicopter reported that the patient's condition had stabilized following on-the-scene medical attention. A third aerial refueling was completed less than one hour and thirty minutes from home—routine, just like the previous two. ETA and patient status were relayed to the Rescue Coordination Center. Medical personnel and vehicles were standing by for the arrival of the rescue helicopter.

Nearly home free, Lieutenant Peters reflected on the success of his first mission as an aircraft commander. Everything had gone smoothly, without a hitch. He was especially happy to have a "save" on his first mission.

Less than a half hour from touchdown, both crews started preparations for landing. But a call from the Rescue Coordination Center brought news that a local television station crew would be filming their arrival and interviewing both crews.

Major Hawkins received priority handling from approach control and smoothly settled on the helipad. Lieutenant Peters circled overhead until the Jolly Green landed and then maneuvered his Herky Bird for a landing.

The helicopter taxied up and stopped in front of base operations where an ambulance was waiting. Meanwhile, the whole scene was being captured on film by the television camera crews. As Major Hawkins shut down the chopper, Lieutenant Peters completed his first landing as a mission aircraft commander. His "grease job" landing provoked some sly comments from the other crew members. As the HC-130 taxied in, the crew members stood up in the cockpit to get a glance at all the activity in front of base operations. The copilot jealously remarked that chopper crews always get all the glory. Lieutenant Peters said that he'd get his aircraft and crew on celluloid by squeezing between a C-118 and the chopper. As he wedged his Hercules between the parked aircraft, he noted that the cameras were still turning and that they were about to make their film debut. The navigator, flight engineer, and radio operator crowded in behind Lieutenant Peters, eager for a look. In the excitement of the moment, the young AC didn't realize that there were no marshallers to "wing-walk" his aircraft into the tight spot. A few feet short of its triumphant halt next to the HH-53, the crew felt a terrifying, grinding noise as the aircraft lurched to the right. The right wing tip had rammed the C-118's left wing, ripping a gaping hole. Fuel streamed out of the ruptured outboard main fuel tank and ignited as it contacted number four engine.

Momentarily paralyzed with fear, Lieutenant Peters instinctively applied his emergency procedures. He ordered aircraft evacuation, set the parking brake, pulled all four fire emergency control handles, and placed the engine condition levers to "feather."

All four propellers stood motionless as the crew evacuated and assembled about 150 feet in front of the aircraft. The cameras were still turning as the fire department fought the fire. There was no confident smile on his face now as his thoughts went back to his commander's words, "The primary responsibility of an aircraft commander is for the safety of his crew and aircraft, regardless of the importance of the mission!"

ABOUT THE AUTHOR

Captain Walts graduated from the USAF Academy in 1969. He attended flight school at Columbus AFB, Georgia, earning his pilot's wings in 1970. Captain Walts later flew HC-130's for the 76 ARRS at Hickam AFB, Hawaii. He is presently assigned to the 1551 FTS at Kirtland AFB, N.M., as an HC-130 instructor pilot.

Most every day is Mother's Day when Dad's away in his flying machine.

That's My Mom

Hi! . . . Yeah, they're kinda pretty. I'm picking these flowers for Mom for Mother's Day. She likes flowers . . . But she's not home now. She went to the commissary. I guess that leaves me in charge.

Mom says I'm the man of the house when Dad's gone. It's kinda neat; I get to boss the other kids around. You know, my Dad works for the Air Force and flies on a big airplane he calls "Fat Alice"—or something like that. We kids and Mom are left alone lots of times, but Mom says that's all part of being in the Service. She likes the Air Force a lot. The other day I heard her tell Dad, "You know, I think our Air Force friends are the best friends we've ever had." Then Dad reminds her that our Air Force friends are the only friends we ever had!

Mom's all the time making us kids laugh, and sometimes she doesn't make too much sense. Like a couple of weeks ago, when Dad got home from a trip, she tells him, "Gosh, it's so good to have you home." And then last night, before he left on another trip, she says, "I'm glad you're leaving; now I can get my housework done and do some shopping." I don't understand that, do you?

My mom is very pretty. When she gets all dressed up for one of those dances or whatever it is, she looks great—I mean, wearing a long dress, and Dad with all his medals. They're really a neat couple. Especially Mom—but, if you could have seen her yesterday, you might not have thought so. Ginny's cat climbed a tree, so Mom put on a pair of Dad's overalls and went to get it down. About the time she had the cat cornered, the Avon lady came by and yelled up, "Hey, Mr. Brown, is your wife home?" We all laughed.

How did you know she's a Den Mother? Well, I bet you didn't know that when Dad's gone, she has to drive the Boy Scouts out to Camp Waubonsie Friday evening and pick them up Sunday. She's getting pretty good at driving Dad's van. Dad thinks she can get a job with Greyhound after he retires.

Yes, you're right. We are kinda new in the neighborhood. That's probably why you haven't met my mother yet. No, Mom likes to move. It's a good thing, 'cause we've moved three different times that I can remember. She always tells us how much fun it's gonna be. But sometimes I'm not so sure about that—I saw her crying when she saw Mrs. Smith for the last time before we left California. And she calls her friend Mary Jane in Delaware about once a month, "just to say hello," she says.

Oh, I guess all moms are sentimental. The other day Mrs. Taylor, our neighbor, showed me an old picture. "That's Tom when he only had two ribbons—and two kids," she laughed. Mom's favorite picture is of her and Dad at their wedding. "He'd just gotten promoted," she says, "and I was so proud!" I think she still is. Proud of Dad, I mean.

Gee, I wish she'd come home. I know you'd really like her.

You've gotta go? Too bad. But you'll probably meet her on the way home. If you see a real beautiful lady driving a minibus loaded with groceries and she's smiling and waving at everybody—you wave back, because that's my Mom!

Mishap with a Moral

Wind Shear at the Middle Marker

Buffeted by 40 knot-winds and moderate rain, a DC-10 began its approach into an airport obscured by fog, rain, and low ceilings. Approach control vectored the jumbo jet on a dogleg to ILS final and subsequently cleared the flight for an ILS approach to runway 33 left. It intercepted the glide path with autothrottles and autopilot connected.

The aircraft remained on the glide slope until the captain disengaged the autopilot near the middle marker after the flight engineer called "three hundred feet." Almost immediately, the first officer spotted the approach lights off to his right at about the one to two o'clock position. The captain looked up, saw the lights, and manually banked the jumbo to align it with the runway. The autothrottle system remained coupled to the automatic speed command of 145 knots. After the pilot aligned the aircraft with the runway, the flight engineer called "decision height." Realizing that the aircraft was below glide path and low, the captain manually overrode the autothrottle system and increased back pressure slightly. In spite of the corrections, the DC-10 remained low and both the first officer and flight engineer cautioned the captain. More power was applied but the jumbo continued its rapid descent and the aircraft's right main landing gear struck an approach light pier and was ripped off. Bouncing back into the air from its initial impact, the aircraft settled onto the runway and skidded off the right side. As it ground to a halt, fire broke out on its left side. The captain ordered the aircraft evacuated and all 153 passengers and 14 crew members egressed. Fifteen passengers and one crew member were injured during the emergency.

What Really Happened?

Based on the above, one might conclude a simple case of "duck under" and pilot error. But not this time.

Processed data from the aircraft's flight data recorder revealed normal approach profile and flight characteristics prior to glide slope interception and during much of the approach after passing the outer marker. But as descent continued to decision height, the recorder registered an abrupt airspeed change and a steady deviation to the left of the localizer, above the glide slope.

Three seconds after the captain disengaged the autopilot, the rate of descent increased abruptly. The captain added power, but the rapid descent continued, averaging 1,060 feet per minute

Altitude (feet)	Direction (magnetic)	Speed (knots)	Longitudinal Component	Lateral Component
1,000	191°	35	23.0 tail wind	26.0 left crosswind
900	191°	32	22.6 "	25.7 "
800	193°	31	22.15 "	25.4 "
700	195°	30	21.7 "	25.1 "
600	197°	28	20.4 "	24.3 "
500	200°	24	18.0 "	23.0 "
400	205°	20	11.8 "	17.3 "
300	225°	15	5.8 "	12.1 "
200	260°	12	3.3 head wind	4.1 "
100	310°	8	6.0 "	2.0 "
Surface	315°	8	4.0 "	2.0 "

Approximate winds encountered by the DC-10 during its ILS approach to runway 33.

Both the first officer and flight engineer cautioned the captain.

during the nine second period following autopilot disengagement. Shortly thereafter, the aircraft struck the approach light pier.

Why did the aircraft continue to sink lower and lower in spite of power application with more than adequate airspeed? Wind shear. Using recorder data, investigators determined the direction and velocity of winds from 1,000 feet above the ground to the surface. As Figure 1 illustrates, variations in wind speed and direction were severe and contributed to deteriorated aircraft performance.

Additional flight recorder data showed that the aircraft descended from 500 feet to 200 feet in 20 seconds. During this period, the longitudinal wind component changed from an 18-knot tail wind to a 3.3-knot head wind and the crosswind decreased from 23 to four knots. Between these altitudes the shear gradient averaged 7.1 knots per 100 feet and the lateral shear 6.3 knots per 100 feet.

The data clearly indicate the adverse effects of wind shear on the flight. During the initial portion of the ILS approach, the higher-than-normal rate of descent, lower-than-normal pitch attitudes, and the thrust settings were consistent with a fairly constant tail wind. The eight to ten degree difference between aircraft heading and localizer course was necessary to offset the left crosswind. The aircraft flight profile remained essentially stable and localizer/glide slope deviations were minimal until the aircraft descended to 500 feet. At this point, airspeed increased rapidly, and the flight deviated above and to the left of the ILS localizer and glide slope. To compensate for these deviations, the aircraft (still automatically coupled to the ILS) pitched down, reduced thrust, and corrected to the right. Upon passing 200 feet, the captain disconnected the autopilot because the glide slope was unusable below that altitude. At the point of autopilot disconnect, the aircraft was established in a low pitch attitude left of the localizer in a low thrust condition. The effect of the low thrust was evident in the recorder data as an actual aircraft deceleration over the ground.

In simulator tests conducted following the accident, transition from automatic to manual flight control in a similar wind shear envelope produced a serious degradation in aircraft performance. The simulated aircraft quickly and insidiously developed a high sink rate which required immediate significant increases in pitch attitude and thrust to arrest. Had the captain of the DC-10 been able to retain autopilot coupling to touchdown, these corrections probably would have been automatically made. But he had to disengage the automatic system. When this occurred, the captain became dependent on visual and sensory cues to alert him to the need for control inputs.

Although he had sighted the approach lights, he could not see enough of the runway to derive an accurate perception of attitude and altitude. Moreover, at the point of autopilot disconnect, the aircraft was on the glide path. The captain had no reason to anticipate the need for immediate pitch and thrust corrections.

The subtle increase in the rate of descent and the more obvious need for lateral correction prolonged his recognition and reaction time. He eventually realized that the aircraft was sinking, but pitch and thrust inputs were insufficient to arrest the sink. Impact short of the runway became inevitable.

Another factor in this accident disclosed by investigators was the low clearance between the jumbo jet and threshold crossing height (TCH) of the ILS glide slope beam. Had the aircraft remained on the glide path, its main landing gear would have passed only 24.6 feet above the approach light pier and 7.8 feet above the runway threshold. Incidentally, the TCH was not published in official instrument approach procedures and was unknown to the captain of the DC-10.

Cause Factor

Investigators concluded that the probable cause of this accident was that the captain did not recognize an increased rate of descent in time to arrest it. The increased sink rate was induced by an encounter with low altitude wind shear as the captain transitioned from automatic to manual flight control in instrument flight conditions. The captain's ability to detect and arrest the increased rate of descent was adversely affected by the lack of wind shear information and marginal visual cues. Minimal wheel clearance above the approach lights and runway threshold made response time critical and produced a situation that greatly diminished the pilot's ability to make a safe landing. Fortunately, there were no fatalities in the crash landing.

A brief review may help explain why wind shear can be treacherous.

Wind Shear Phenomenon

The problems associated with wind shear have been confined to the effect of shear on the aircraft's touchdown point, assuming no control or thrust changes. Such information appeared in THE MAC FLYER in June 1975. But, apparently, little research and investigation has been done to consider the effect of the pilot's performance during wind shear penetration.

When encountering wind shear on final approach, the pilot or autopilot must make immediate pitch, thrust, and heading inputs to minimize shear-induced deviations from the glide slope and airspeed. The severity of shear-induced deviations depends upon local shear characteristics and the response of either automatic or manual flight control system inputs.

During a precision approach through a wind shear condition characterized by a diminishing tail wind, the higher-than-normal ground speed produced in an initially stable tail wind requires higher-than-normal rate of descent for the aircraft to remain on the glide slope. Under such conditions, a pilot can expect a lower pitch attitude and less thrust than required for the same approach in a no-wind or constant head wind condition. When the tail wind component rapidly decreases, the velocity of the aircraft relative to air mass rapidly increases. This increased velocity will immediately show up as increased IAS and lift, causing the aircraft to rise above the glide slope. The common tendency when this occurs is for the pilot to recenter the glide slope indicator and limit airspeed by putting the nose down and throttling back even further. As the pilot again intercepts the glide path, he normally increases pitch and advances power to maintain glide slope profile. Nothing new here. But consider the tail wind that continues to diminish or shears out into a head wind component. Unlike a steady head wind or no-wind ILS, the pilot must make continuous increases in pitch (nose up) and power through the shear zone. After passing through the wind shear zone into a steady head wind, the aircraft is likely to descend below the glide slope. Prompt pitch increases and throttle advancement are necessary to prevent increasing sink rates.

The hazard induced by a diminishing tail wind-type shear on final approach is accompanied by the continuous need for pitch and power increases not commonly required during a no-wind or steady head wind approach. If the wind shear condition intensifies at lower altitudes, the aircraft (and pilot) can be sucked into a high sink rate and a thrust deficient envelope. Under these conditions, pilot responses, human or black box, may be critical.

Autorotation

Losing power in a helicopter can be a real downer, but knowing the finer points of autorotation can increase the odds for a gentle touchdown.

The helicopter? Here's what Wilbur Wright once said about it . . .

Like all novices we began with the helicopter (in childhood) but soon saw it had no future and dropped it. The helicopter does, with great labor, only what the balloon does without labor, and is no more fitted than the balloon for rapid horizontal flight. If its engine stops it must fall with deathly violence, for it can neither float like a balloon nor glide like an airplane. The helicopter is much easier to design than an airplane, but it is worthless when done.

—15 January 1909.

Time has proved that Mr. Wright badly underestimated the potential of the helicopter. We don't have space enough to discuss all the flaws in his assessment of rotary wing aircraft, but we would like to talk about what happens to a helicopter when its engine quits. Contrary to Wilbur's opinion, it does not "fall with deathly violence." In a helicopter, there's a region of flight between power failure and landing called *autorotation,* and it is this region we would like to discuss.

All helicopter pilots learn autorotation procedures during training, and they learn them so well that the percentage of successful actual autorotations is very high. But we still see occasional accidents caused by problems which turn up on the way down after an engine failure; accidents that should never have occurred. Part of the problem may be a lack of understanding of what is involved in a successful autorotation.

It is easy to establish, practice, and remember rote procedures for autorotations. However, the pilot who fully understands not only the procedures but the principles behind them is better equipped to complete an actual autorotation, should he ever have to.

Vertical

Aerodynamically, the simplest form of unpowered helicopter flight is a vertical autorotation. Admittedly, this is rare in the real world but it will serve as an excellent starting point for our discussion. Let's assume that we have a helicopter in a vertical autorotation and see just what is happening.

To understand autorotation, we must take a close look at the airflow around the rotor blades. There is an upward flow through the rotor disc, equal to the rate of descent of the helicopter, which gives each blade a vertical wind component. There is also a wind component equal to the rotational velocity of the rotor. The resultant of these two component vectors gives us the relative wind for any section of the blade.

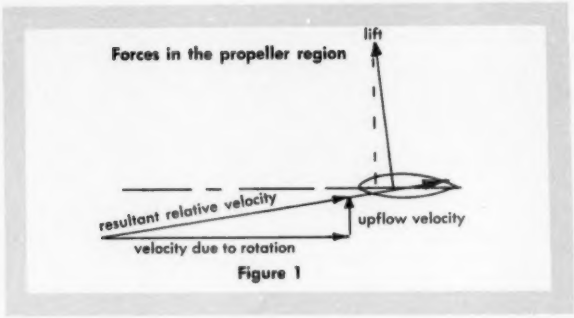


Figure 1

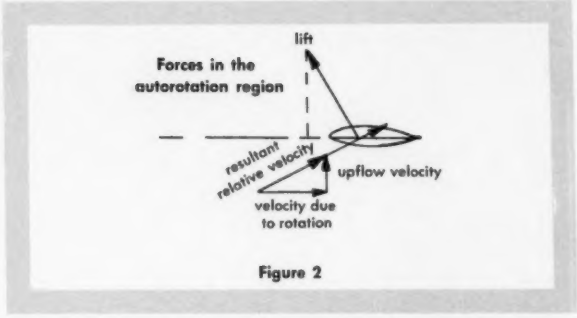


Figure 2

Now, let's consider a blade section located near the tip of the rotor, as shown in figure 1. The rotational wind velocity is very high compared to the upward velocity caused by the helicopter's descent. As a result, we have a large lifting force acting almost straight up and drag working in opposition to the direction of rotation. This portion of the blade is creating usable lift but isn't maintaining the rotation of the rotor.

To find out why the rotor keeps turning, we must examine a section of the blade located about halfway between the hub and the tip. In figure 2 we see that the rotational velocity is much less, compared to the vertical wind component, than it was at the tip. The resulting lifting force is tilted in the direction of rotation, and here's our answer. This portion of the rotor blade is producing the force necessary to keep the rotor turning. Further inboard, near the rotor hub, the rotational velocity is so low that the blade is stalled and produces neither lift nor rotational force.

Each blade, then, has three aerodynamic zones, and we can consider the rotor disc, in a vertical autorotation, to be made of three separate regions. The outer ring of the disc is the propeller region and furnishes the lift necessary to keep the helicopter from becoming a free-falling object. The middle ring may be called the autorotation region and furnishes the power to keep the rotor turning while the innermost disc is stalled and contributing nothing either way. These regions are shown in figure 3.

Forward

Now that we've discussed a vertical autorotation, let's give our helicopter some forward velocity and discuss a situation more closely related to the real world. Figure 4 shows the rotor disc in a normal forward autorotation. While similar to a vertical autorotation, the autorotation region of the disc has shifted to the left due to the direction of rotor rotation, and there is a new, small region of reversed flow near the center of the disc.

Normally, a given rotor system will automatically maintain a constant r.p.m. during autorotation—it is in a stable flight condition. If an external disturbance slows the rotor, the autorotation region of the disc will automatically expand and drive the rotor back to its normal speed. If a disturbance should cause an r.p.m. increase, the propeller region will increase in size and bring the rotor back to its normal speed. This principle is most evident in the old autogyros which, with fixed pitch rotors, maintained a constant rotor r.p.m.

Actually, the stable autorotation exists only if the rotor r.p.m. is maintained within certain limits. The limits vary from aircraft to aircraft, but if rotor r.p.m. is allowed to decrease too much—in any helicopter—the rotor will become unstable, and r.p.m. will continue to decrease unless the pilot takes some corrective action.

Transition

Now that we've examined stable and unstable autorotation, let's see what is involved in the transition from normal powered flight to autorotation.

During normal forward powered flight in any helicopter, the rotor blades are operating at a relatively high positive angle of attack, producing lift and drag, and the engine is producing torque to turn the system. The entire rotor disc is tilted forward, presenting the upper surface of the disc to the relative wind and tilting the lift vector so that part of it may be used as thrust. If the power of the engine is suddenly removed, the blades are left in a high angle of attack–high drag configuration, and rotor r.p.m. will immediately begin to drop. The airflow, which was striking

the top of the rotor disc, will also tend to reduce rotor r.p.m.

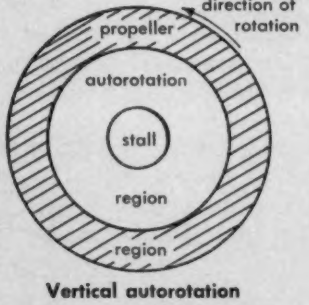
The rotational energy of the rotor system will determine the rate at which the r.p.m. will decay. If the r.p.m. is high, the decay rate will be slower than if the rotor were at low r.p.m. when the power failed. An engine failure with very low rotor r.p.m. may result in such rapid decay that the pilot is unable to react quickly enough to maintain adequate rotor speed.

Normally, to enter autorotation the pilot must accomplish two things: He must lower the collective to reduce the pitch angle of the blades and maintain rotor r.p.m. and he must apply after cyclic to present the lower surface of the rotor disc to the relative wind.

During the transition to autorotation, the helicopter could lose considerable altitude. The exact amount will vary with the type of aircraft involved, the pilot's technique (or lack of it), and several other factors. For a small helicopter it might take about 300 feet to establish a stable autorotation. The figure is about 500 to 600 feet in large helicopters and may be higher for aircraft with increased disc loading. With enough airspeed available when the power is cut, a pilot may enter autorotation with no altitude loss by applying aft cyclic and trading airspeed for altitude. However, conditions must be ideal, and the pilot's technique must be flawless.

Once established in autorotation, the helicopter is essentially an unpowered autogyro, with one exception. The helicopter pilot can still change the collective pitch of his blades. With this ability, he can control the percentage of the rotor disc area which is in each of the regions we discussed earlier. He can increase the size of the propeller area by increasing collective pitch, adding to his available lift but decreasing the autorotation region and sacrificing rotor r.p.m. Or, by decreasing collective, he can increase the size of the autorotation area, increasing r.p.m. and losing available lift. This feature of the helicopter offers the pilot a couple of options during his autorotation and enables him to make an autorotational landing with no forward speed—something an autogyro can't do.

Figure 3



Vertical autorotation

Range or Rate?

As we remember from basic aerodynamics, a fixed-wing aircraft has two power-off gliding speeds. For maximum gliding distance, the aircraft should be flown at the airspeed that produces the maximum lift over drag ratio. For minimum rate of descent, the aircraft should be flown at a somewhat lower airspeed. A power-off helicopter operates the same way, except that rotor r.p.m. is also a consideration.

The flight handbook will furnish specific figures for any helicopter but we can generalize by saying: "For maximum range, we want high airspeed with low rotor r.p.m., while for minimum rate of descent we need low airspeed with high rotor r.p.m." These considerations influence the pilot's actions while he is establishing autorotation after an engine failure.

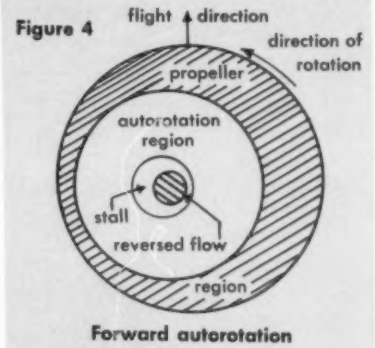
If range is critical, as it would be if the pilot were trying to make it to a shore line or reach a clear area some distance away, he must maintain airspeed while transitioning to autorotation. He would present the lower surface of the rotor disc to the relative wind less rapidly by using minimum aft cyclic and applying it slowly.

If the pilot wants to stay airborne as long as possible to attempt restarts or prepare for the landing, he will change disc attitude rapidly and sacrifice airspeed to hold altitude, but may lower the collective pitch more slowly. If he must make any turns, he'll use the shallowest possible angle of bank to minimize altitude loss and conserve his time in the air.

Flare

After establishing autorotation, the helicopter pilot faces only one small

Figure 4



Forward autorotation

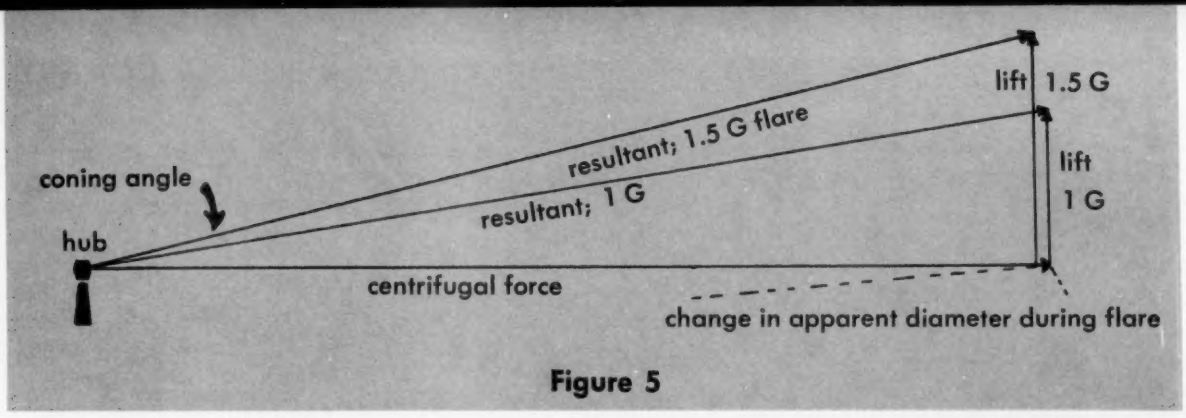


Figure 5

problem—the landing. The success of a power-off landing in a helicopter depends on the inertia built up in the rotor system during the descent. The pilot, by increasing collective pitch at the right moment, can convert this energy to additional lift to slow his rate of descent to near zero at touchdown. Since the amount of inertial energy available depends mainly on rotor r.p.m., the more the better. But we have just discussed situations in which the pilot would want to descend at less than the maximum rotor r.p.m. —to gain maximum range, for instance. And even minimum rate of descent autorotations, in many helicopters, are flown at less than the maximum possible rotor r.p.m. How can we get maximum r.p.m. for the landing? By flaring the helicopter. Let's take a look at what happens.

The aircraft is approaching the landing site with less than maximum allowable rotor r.p.m.—the pilot has the collective up to some degree. At a given altitude, depending on the type aircraft and approach, the pilot coordinates aft cyclic and bottoms the collective, raising the helicopter's nose and beginning a flare maneuver. This slows the helicopter's forward speed and increases the rotor blades' angle of attack. Or, to look at it another way, it exposes the bottom of the rotor disc more directly to the relative wind and increases the upflow of air through the rotor disc. This increases the autorotative area of the rotor disc which increases rotor r.p.m.

Also, in some helicopters, the law of conservation of energy helps increase rotor r.p.m. In the flare, the helicopter's load factor is increased. This increases the apparent weight on the rotor system, which responds by increasing the coning angle. Figure 5 shows that the coning angle is the resultant of centrifugal force and lift, and since lift equals weight, the apparent diameter of the rotor system decreases. Since, according to the law of conservation of energy, the total kinetic energy of the rotor system must remain constant, the increase in coning angle and decrease in diameter forces an increase in rotor r.p.m. It's the same principle as when you sling a weight on a string around your finger. As the string winds itself around your finger, the diameter of the circle decreases and the r.p.m. of the weight increases.

Touchdown

As the rotor reaches its maximum r.p.m. in the flare, the pilot deftly levels the aircraft just above the ground with maximum rotor r.p.m., no airspeed, and minimum rate of descent. All that remains is to convert the energy in the rotor system to lift by increasing collective pitch as the helicopter settles to the ground. This increased collective will produce drag, slowing the rotor, but the helicopter should be on the ground before rotor r.p.m. drops too low. If everything has been done properly, the chopper will come to rest safely on the ground with its rotor unwinding slowly.

One other type of autorotation we should mention involves an engine failure at very low altitude and low airspeed. In this situation there is not enough energy in the rotor system to establish stable autorotation, but recovery is still possible. When the engine failure occurs, the collective pitch must be held constant and increased just before touchdown. Rotor r.p.m. is never stabilized and continues to drop throughout the maneuver. If the attitude and airspeed are low enough at the beginning, a safe landing is possible, but the maximum altitude is only about ten feet.

•

Most helicopter pilots consider autorotations simple maneuvers. Our purpose has been to explain that, though they may be simple, there are some fairly complex aerodynamic principles involved. The better you understand these principles, the better your chances of successfully completing a "simple" autorotation.

Global Notes

associate editor departs

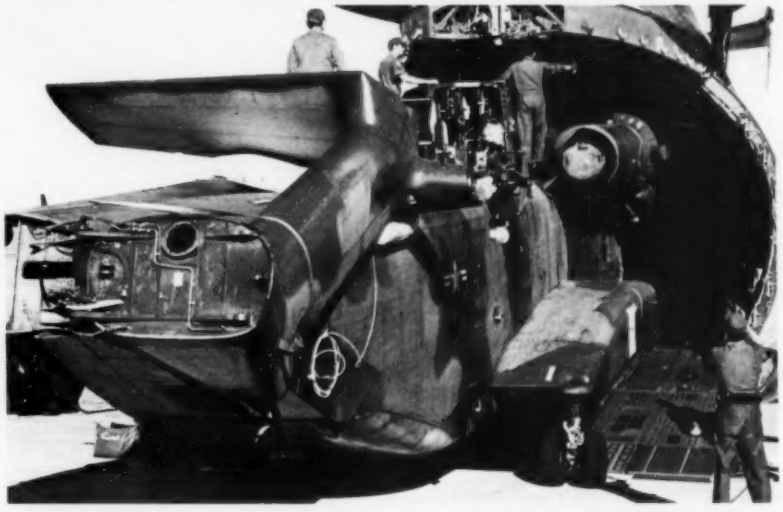
Supervising editor, Lt Col John Ray, presents bound volumes of THE MAC FLYER to departing Associate Editor Major Albert R. Barbin, Jr. "Big Al" is leaving the FLYER after nearly three years to take charge of the T-39 Central Training School at Scott AFB.

new associate editor

Joining the FLYER staff as Associate Editor is Captain Bruce L. Gumble. He comes to us from McChord AFB, Wash., where he was officer in charge of the C-141 flight simulator.

leaving Korat

The phasedown in Thailand recently hit home for members of the 40th Aerospace Rescue and Recovery Squadron at Korat RTAB as this HH-53C Jolly Green Giant was loaded into a C-5 for transportation out of the country. The helicopter was one of six assigned to the unit.



doublecross

1st Lt John W. Jirschele, 11 AAS, Scott AFB, Ill., was awarded the MAC Distinguished Individual Safety Award for the sound judgment he exhibited during a taxiing incident.

After a routine approach and landing, control instructed Lieutenant Jirschele to taxi to the ramp via an active runway, but to hold short of the runway for a departing flight of two F-4's. He stopped his C-9 short of the yellow hold line, approximately 2,000 feet from the approach end of the runway. The two F-4's were cleared for takeoff, but as the lead plane initiated his takeoff roll, he informed tower that the second fighter was aborting. Tower then cleared the air evac to taxi across the runway.

His visibility partially obscured by blowing snow, Lieutenant Jirschele visually checked the runway. He observed the second F-4 light his afterburners and commence his takeoff roll. Applying brakes, he brought the C-9 to a stop short of the passing F-4.

slide on landing

1st Lt. John A. Elrod and 1st Lt Marvin C. Champion, Det 4, 37 ARRS, Little Rock AFB, Ark., were alerted to a hydraulic system malfunction by cockpit warning lights and feedback on the flight controls. The pilots followed emergency procedures, made the decision to land at a nearby base, and brought their HH-1H in for a perfect hydraulics-off slide landing. The skillful emergency landing performed by pilot Elrod and copilot Champion prevented the possible loss of a valuable aircraft and injury to its crew. Both pilots received MAC Distinguished Individual Safety Awards.

1975 MAC Sa

The MAC Trophy for Flying Safety

To the MAC air force or service with the most effective flying safety program as determined by major aircraft accident rate.

Twenty-Second Air Force

MAC Distinguished Wing Flight Safety Award

Goes to the best wing from among those receiving the MAC Flight Safety Achievement Award.

1550th Aircrew Tng and Test Wg, Kirtland AFB

MAC Support Safety Achievement Awards

Recognizes units with excellent quality of services rendered, based on safe mission accomplishment

TUSLOG Det 175, Incirlik, Turkey
603d Mil Alft Spt Sq, Kadena AB, Japan
610th Mil Alft Spt Sq, Yokota AB, Japan

MAC Flight Safety Achievement Awards

Presented to wings that are accident free and have effective flight safety programs.

89th Mil Alft Wg, Andrews AFB
375th Aeromed Alft Wg, Scott AFB
1550th Aircrew Tng & Test Wg, Kirtland AFB
39th Aerosp Resc & Recovy Wg, Eglin AFB
317th Tac Alft Wg, Pope AFB
436th Mil Alft Wg, Dover AFB
63d Mil Alft Wg, Norton AFB
443d Mil Alft Wg, Altus AFB
463d Tac Alft Wg, Dyess AFB

fety Award Winners

MAC Safety Officer of the Year Awards

Presented to one primary duty and one additional duty safety officer for outstanding achievement in support of the MAC safety program.

PRIMARY DUTY
Capt Roland J. Page
37th Aerosp Resc & Recovy Sq
F.E. Warren AFB, Wyo.

ADDITIONAL DUTY
Capt Terry R. Lowe
53d Mil Alft Sq
Norton AFB, Calif.

MAC Safety NCO of the Year Awards

Presented to one primary duty and one additional duty safety NCO for outstanding achievement in support of the MAC safety program.

PRIMARY DUTY
SSgt Ira C. Lunt
2d Wea Wg
Ramstein AB, Germany

ADDITIONAL DUTY
TSgt Jerry K. Moretz
437th Orgn Maint Sq
Charleston AFB, S.C.

Return to

Lieutenants Matt Robina (MAC) and Jim Harland (ATC instructor pilot) heading for their T-37.

Some of MAC's C-141 co
And one of them

Roger, Colt 59, you're cleared three sixty overhead for landing runway two-two right. Report break," the control tower crackles as the T-37 streaks in on initial.

The control tower is at Mather AFB, Calif., and besides being a T-37 pilot, the jock doing the flying is a MAC C-141 copilot. In a few seconds he'll be breaking left and pulling the kind of G's that most C-141 pilots have not withstood since the class of so-and-so graduated and went their separate ways.

The instructor pilot with the Air Training Command patch on his Nomex tells the MAC guy that he's looking good. The MAC guy glances to his right to acknowledge and then breaks.

"Mather, Colt 59 in the break."

"Looking good still," says the instructor. He positions his hands toward the flight controls as the Cessna turns final. He knows what's going to happen next. After all, compared to the cockpit height of a C-141, the Tweety Bird cockpit sits near basement level.

"Watch me squeak this muthah in," predicts the MAC man. He really believes he's going to, because he's trying hard. And this bird is so easy to fly, and . . .

"Ooops, rounded out high again."

The instructor smiles.

"That's okay. We'll log two flares and one touch-and-go. You'll get it back. Just takes a little practice."

"Yeah," replies the MAC copilot, "but my alibi is that I just got back from a C-141 trip not long ago. And guess what I was doing on landing then."

"Not rounding out low?"

"You guessed right," grins the student, "but like you say, I'll get it back."

He and other MAC cojocks have made MAC history in what is known as the Air Force Low Cost Aircraft Augmentation Test. You're probably more familiar with its informal name, "Constant Growth," or simply "Low CAT."

MAC participation in the program began in October 1975 with 38 low-time pilots from Travis AFB. This group was divided into five smaller groups, each of which cycles through the Tweet program every five weeks. MAC and SAC "heavy" drivers are piloting the T-37 while TAC pilots fly the T-38. The object of the program is to determine whether it's possible to cut down

Tweety

Checklist—ATC style

ilots are wearing two hats.
s a crash helmet.

on the cost of training without demeaning the quality of the pilot force.

The kicker to the unusual program is that not only do the MAC pilots zoom around in their T-37's—they also maintain currency in the C-141. The smaller, more easily maintained T-37 provides a kind of "general" training, while the C-141 is used for the "specialized" training necessary for the primary weapons system.

Background

A "hump" of young copilots, a cutback in weapons system flying time, and a reduction in ATC output due to RDTMS (Rated Distribution Training Management System) prompted Air Staffers to take a second look at managing and training a core of professional aviators for the future. This is what they came up with as a possible solution.

A Week at Mather

At Mather, Air Training Command runs the entire program and is responsible for all operations and maintenance. Classroom work is typical "learning center" style. ISD programs have been developed to reacquaint the MAC pilots with the T-37 systems.

The recurring schedule calls for six fly days and one weather day. During the week the MAC types are programmed to get about 17 hours in the T-37. Emphasis is placed on instruments, landing at strange airports, flight planning, and radio work. Some acrobatics are allowed. At this writing, 12 MAC pilots have upgraded to first pilot permitting their ATC instructors to take a few days off while all MAC two-man crews whistle up and down the valley. Plans call for the entire group to upgrade to first pilot.

During a week's training at Mather, MAC pilots fly two locals on Monday, Thursday, and Saturday. Tuesday is cross country day. The pilots usually take a three-hopper down the valley and RON—if they're really lucky, at Las Vegas. They return to Mather Wednesday. Friday is "out and back" day, usually with landings at three fields. That leaves Sunday for a weather day.

Hard Work

The program is designed so that the young copilot spending 20 percent of his time away from the C-141 won't suffer a loss of Starlifter experience. Overmanning in copilots should give most of the pilots the advantage of getting "extra" T-37 time without detracting from their MAC routine.

The best of both worlds? Perhaps. There is a lot of hard work involved. Flying three

sorties a day, saddled with back-pack parachute, nose hose, brain bucket, and without your friendly loadmaster serving coffee, the MAC cojocks are recalling some of the forgotten tortures associated with flying an aircraft that one "wears" rather than rides in.

Comments from MAC pilots taking part in the program have been mostly favorable. Judging from the course critiques, most are well satisfied with the relaxed atmosphere in the program—which bears little resemblance to the UPT environment.

Pilots in the program express satisfaction in doing what they call "real" hands-on flying. Apparently, some of the younger copilots feel more like "cruise pilots" in the Starlifter since flying time is pretty hard to come by with present overmanning. One pilot remarked that he did more real flying in the "Tweet" in three days than in the C-141 in three months.

The MAC pilots are being checked out as first pilots in the "Tweet"; a few flights will have MAC pilots in both seats of the ATC minijet. Even in these flights, ATC will own the management and responsibility for safe conduct of the missions.

Future

Will other MAC cojocks be flying the T-37 in the future? That's questionable. But the handwriting's there for those who care to read it. Air Force is looking for ways to economize. JP-4 and flying time may get to be very scarce commodities. You'll most likely see more of the "new and exciting" ideas from Air Staffers.

All aboard!

"Before starting engines checklist."

Up and away.

Down

The snow is melting in a gorge somewhere. Soon— perhaps tomorrow—the melting snow will expose the icy grave of an old friend, a fellow aviator.

To him and the others before him who have filed that same *final* flight plan, these words are dedicated.

You've put me down,
I'm on the ground.
I'll fly no more.
I'll miss my love,
The sky above.
I once did soar

Above the clouds,
When You allowed.
Sun always shone.
I was near You, God,
But now it's odd,
I feel so alone.

I love Your sky,
And by and by,
I'll fly again.
I'll not be bound
To the spiteful ground,
Like other men.

Where I complain
Of the falling rain
And the dusty wind.
And I'll curse the smoke
That makes me choke,
As I breathe it in.

Up there, for sure,
The mind is pure
And all is peace.
I long to glide,
With You beside,
Through cloudy fleece.

Don't leave me here
In all my fear;
Relieve earth's binding weight.
I want to fly
There in Your sky,
Let that be my Fate.

I love Your sky,
And by and by,
If it is Your will,
I'll trade earthly things
For heavenly wings
And guard Your endless still.

—O. L. Brownfield

Where To Go When Fuel Gets Low

Stretching a gallon of JP-4 can save more than just money. Here's how—in terms of dollars and sense.

by **Maj Orlen L. Brownfield**
Associate Editor

Have you ever been really low on fuel? I mean, really low—like beads of perspiration glistening on your forehead? Like really wondering what to do or where to go? Do you climb, descend, slow down, speed up—or give up?

Among all those fuel conservation and JP-4 saving hints are a few "old pilots' tales" that contain various degrees of credence. But determining what's really best for you at any particular time must be a total effort by the flight engineer, navigator, and the pilot.

Of course, the best way to keep yourself clear of fuel problems is through the use of the old "ounce of prevention" trick—good flight planning. It doesn't sound glamorous, but proper flight/fuel planning can be very rewarding in terms of comfort index on the flight deck. You'll never really appreciate it until you need it and don't have it.

Regardless of fuel load, file for your optimum altitude and airspeed. And file a step climb. This way you won't need to load up on fuel for a medium-range trip. Carrying unidentified extra fuel is most expensive and wasteful.

How It Goes

"Pilot, we can climb in five minutes. Want me to request flight level 370?"

"What's the range control chart look like, Navigator?"

"We're below the max line."

"Good—let's stay at 33,000."

Sound familiar?

This could be the beginning of a sad ending. The errors we'll identify in this scenario are minor and, standing alone, wouldn't cause problems for anyone. But put them together and—well, let's take a look at the flight plan and see what might happen.

Time en route: 8 + 40

Mach number: .74

Flight level: Step climb/ 330/370/410

The navigator constructed his range control chart using the .74 Mach side and the appropriate step climb profile. When he reported to the pilot, " . . . below the max line," this only meant that, based on his current information, the flight would arrive at destination with at least alternate and holding fuel *if* their Starlifter was flown according to its preplanned flight profile. The navigator did not mention this and the pilot failed to notice the profile when he reviewed the fuel chart. He did notice the navigator's remark "four minutes behind" flight plan on the chart. And, since they were "fat" on fuel, the pilot eased the throttles up and shortly the Mach indicator was showing .77.

"We'll make up that time," the pilot remarked to the copilot, who nodded.

About an hour later, the navigator reported that ground speed was about 20 knots below what was flight planned and that his last fuel plot was only slightly below the max line. He did not notice that the TAS had climbed from 430 knots to 445 knots.

"Maybe we should climb now," said the navigator.

"As long as we're below the

max line, we'll save that for an option," was the pilot's response.

One more hour. Magellan passed the fuel chart to the second-in-command. His plot—now above the max line.

"Better see if we can't get a higher altitude from airways," the nav said. "This could get serious."

"Okay," the lieutenant responded, "but let's wait for the AC to get back. I don't particularly want to clamp the 'sweep' over my handsome face."

A half hour later, the pilot returned to his seat, having devoured his frozen lunch, talked to a colonel passenger, made a trip to the john, and visited with a leggy young airperson flying space "A."

After a brief discussion, the pilot agreed to climb and the right seater called airways.

Conflicting Traffic

Twenty minutes passed before the C-141 began a climb to FL 370. The AC didn't notice that the engineer's in-flight data indicated a climb to FL 410 was now possible. The engineer didn't mention it; and although the navigator suspected the aircraft probably was light enough to climb to 410, he said nothing.

As the Starlifter leveled at FL 370, everyone on the flight deck breathed more easily. But an hour later, the navigator again, "Where the hell's our fuel going? We're well above the max line now!"

As the pilot eyed the "how goes it" he noted a discrepancy. "Say, Engineer, how come your endurance doesn't agree with the navigator's?"

"Well, Sir, mine is calculated at continuous flight at flight level 370," the engineer answered. "I suspect that the navigator's is for step climb."

"Is that right, Magellan?"

"Yes, Sir, my endurance is figured—At FL 410 like we flight planned."

"Well, where do we go from here?"

A good question.

Truth or Myth?

Climb? Truth! In practically all cases, climbing is the best way to save petrol. As for "saving higher altitude for an option," such an idea parallels the "restoration of virginity." This option could become as useless as the runway behind you if it isn't acted upon promptly. The fuel that was wasted at FL 310 will not be refunded when you finally decide to climb.

Descend? Myth. Though sometimes, such as when flying in very high winds (say, 150 knots on the nose), a descent will yield greater actual range. But this can get tricky. Lower level fuel flow and ground speed must be compared with that being experienced in the jet core. A mistake here could cause you to land even shorter, so explore the climb first.

Slow down? Truth. At FL 310, your Starlifter gets five percent better gas mileage at .74 Mach than at .767. The higher you go, the less effect a reduction in airspeed will have. Reducing to .74 Mach at FL 410 will net a savings of just over two percent. These percentage figures are based on a C-141 with a takeoff gross weight of 260,000 with a zero wind factor. The wind factor might be considered in choosing a slowdown to .74. In very high head winds (say, half that of your aircraft's true airspeed), the gain from a slowdown is negligible; in very high tail winds (again about half that of your true airspeed), your slowdown will pay off with compound interest. But the likelihood of encountering such winds is slim. So the rule of thumb is "Slow down and save" from two to five percent, depending on altitude.

Speed up? Myth. In unique situations of very high head winds (more than one half of your true airspeed), you'll get a little better gas mileage flying at high speed cruise. Also, in very strong crosswinds, you can actually decrease your minus wind factor by speeding up. Say you don't believe it? Then spin it out on your MB-4—a C-141 in a direct crosswind of 200 knots versus a C-130 in the same crosswind. The C-141 (flying 440 KTAS) is experiencing a minus 50 wind factor while the C-130 (flying 280 KTAS) is getting a minus 80 knot wind factor.

If this comparison seems like the old "apples and oranges" bit, try a comparison of .767 versus .74 in the Starlifter. In the same situation, the faster flying bird is consuming 29.8 pounds of JP-4 for every ground nautical mile flown—the slower C-141 is consuming 30.2 pounds. But the savings is only slightly more than one percent, or a thousand

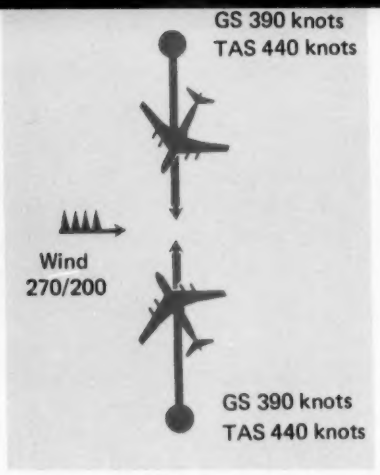


Figure 1
A direct crosswind *always* results in a minus wind factor

pounds saved for every 100,000 pounds consumed. So unless you're flying in extremely high winds, leave this option marked: "Myth."

Another Myth Dispelled

Old pilot's tale: The positive wind factor will never be as high as the opposite direction negative wind factor because the guy flying the negative is in the air mass longer; ergo, it has more of a negative effect. File this one in the wastebasket.

While the first part of our pilot's statement is true, except when the wind is directly off the nose or tail, the cause is not due to spending more time in a head wind condition. Crabbing into the wind to maintain desired track is the culprit here—a very high quartering tail wind can actually yield a negative head wind component due to drift correction. A direct cross wind will *always* give a minus wind factor.

Proof: Take two 141's, one maintaining a due north track and the other maintaining a due south track, in a direct crosswind from the west at 200 knots. Both aircraft will experience a minus 50 wind factor due to the 27 degrees each must crab into the wind to maintain course. See figure 1.

More proof: " . . . the positive wind factor will never be as high . . ." is easily disproved by considering the effects of direct head/tail winds. In such cases (extremely rare), the positive component will be *exactly* the same as the negative.

Where To Go?

First choice: Climb. Climb. Climb. Figure 2 shows what happens to a C-141's specific range when it climbs or slows down. Climbing 4,000 feet from FL 310 to FL 350 increases range by 8.25 percent. Climbing from FL 310 to 410 will increase specific range a whopping 16.8 percent. On a six-hour leg, that's an extra hour at cruise!

Second choice: Slow down. Using figure 2, at FL 310, you'll get five percent better gas mileage at .74 Mach as compared to .767. So if you can't climb, slow down! If you're really in a tight fix, climb *and* slow down. At FL 410 and .74 Mach your specific range will be 18.7 percent greater than your "low level" excursion at .767 Mach.

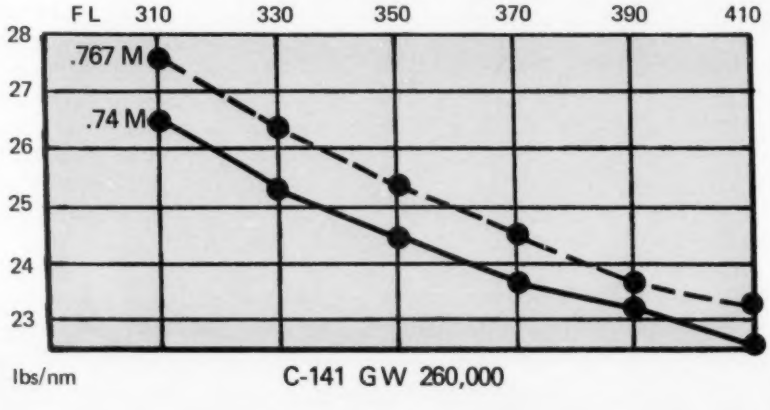
Third choice: Divert. Here's where you must swallow your pride, confess to the entire world that you messed up and that your point of intended landing is somewhat questionable. But do it! Tell the command post that your engineer made a mistake on his Form 52 or the navigator got you lost. Most of us would rather be remembered for our screwups than at our memorial services.

No choice: Speed up or descend. On those rare occasions when savings could be made by either speeding up or descending, you should consider the computation skills of your crew. If a one percent savings is going to save your life, you've really figured it too close, anyway, to be safe.

Proper fuel planning and use is one safety device that doesn't cost money. On the contrary, it may mean spending less fuel money. Any run-of-the-mill aircraft commander who normally files for FL 310 on a six-hour leg will save "Uncle" some $866 in fuel costs by filing for FL 410.

When's the last time you saved $866 in six hours?

Figure 2



The Master Manipulator decides to press on with an early departure but, as usual, he gets caught in the squeeze.

Long Suffering Sam slid into the right seat, buckled in, and flipped open his checklist.

"Okay, Boss, flight plan's coordinated, I've checked the weather, completed the TOLD card, and we're all set to go. But there's still forty minutes before takeoff time."

"Sammy, m'lad, as usual you're a day late and a dollar short," retorted the Master Manipulator as his pudgy hands skipped from switch to switch. "I'm already down to the before-lighting-off checklist. If you don't cease fumbling through the yellow pages, we're gonna be up to thirty thousand feet before you get to the lineup checklist."

"Sorry, Boss."

"Apology noted and accepted, m'boy," chanted C. R., stuffing an Egyptian Oval into his battered ebony cigarette holder. "Nor do I recommend that youngsters such as yourself employ the old 'checklist by memory' trick. Strictly for us experts."

So stating, the Lothario of the Airways flicked his bejeweled Thai lighter and lit his cigarette.

"Holy cats," cried Sammy, "you're not going to smoke before we're airborne, are you? You could start a fire!"

"Tsk, tsk, Sam," reasoned the Rotund One, "the only volatile substance around here is in the fuel tanks, right? And they're some distance from this small tip of ash in my mouth. Another one of those ancient rules that those Pentagon twinkies never thought of rescinding. Call tower and tell 'em we're starting our blow torches."

"Stand by, Sir—clearance is coming through. Ready?"

"Need you ask, m'lad?" answered C. R., tugging on his leather flying gloves.

"Coffee 13, cleared to destination as filed with the following amendments. After takeoff, turn left 230 degrees. Maintain 3,000 feet. Expect flight level 350 ten minutes west. Cross Adair VOR 327 degree radial at or below 2,000 feet, direct Wild Rice intersection, direct Dixon, flight plan route. Contact departure control on 121.7 or 333.2. Squawk mode three, code 2760 prior to departure. Read back."

Sam scribbled down the clearance and read it back.

"Gee, Major Terror, that's quite a change from the way we filed. I'll see if I can find all the points on the map and . . ."

"Never mind, m'boy," interrupted C. R., "they'll probably just give us radar vectors to Dixon anyway. Won't have to use any of that Mickey Mouse departure clearance unless we lose radio contact or the departure control building burns down, hee, hee."

"Maybe so, but I'd feel better if . . ."

"Never mind, Sammy. Starting Engines Checklist. Got a light on number two . . ." Within a few minutes C. R. was taxiing out for takeoff as Sammy scrambled to catch up on the checklist items.

"Stand by to blast off, Sammy," cried C. R. gleefully. He released the brakes and the aircraft shot forward. "We're about to fling our craft through footless halls of air."

Sammy contacted departure control as the aircraft disappeared into the darkness.

"Ask 'em for radar vectors, Sammy," directed the Able Aeronaut, "or we'll never make it back home before the VFW Club closes."

"Sorry, Coffee 13, unable radar vectors due to traffic," apologized the controller. "Proceed as cleared."

"Holy smokes," cried Sammy, scrambling to locate Adair VOR and Wild Rice intersection on his airway chart. "I didn't have time to locate the points and I don't see them now on the map. I'll ask approach control the Adair frequency."

"Stand by one, Sammy, boy," insisted the Idol of the Airlanes, "you don't want those ground pounders to think they know something that we don't."

C. R. turned the cockpit lights on full bright, flew the aircraft with one hand, spread the chart over the instrument panel with the other, and began thrashing it about.

"Coffee 13, say altitude," came on the departure controller.

"Yikes, Sammy," chided C. R., peering out from behind the map at the altimeter, "you let me overshoot our altitude . . . . departure, ah, ahem, we've just leveled at two thousand as cleared." The Master Manipulator dumped the nose and raced toward the safety of his assigned altitude.

"Roger," answered the controller. "We had you at two thousand, eight hundred."

"Ah, request . . . hmm . . . latest altimeter," alibied the World's Greatest Silver Tongue. "We must have a bad one." He grinned sheepishly at his far-from-smiling copilot.

The controller gave the flight an altimeter setting identical to the one already set in and instructed the Dynamic Duo to contact Kaycee Center.

"Traffic is pretty heavy on both UHF and VHF center frequencies, Sir, but I'll report to center as soon as I can get a word in," advised Long Suffering Sam, "and I think we're supposed to be flying 230 degrees still."

C. R. looked up from his chart. The aircraft was heading 180 degrees. "Come on, Sammy, how do you expect to upgrade if you don't help your AC navigate?"

"Sir, I'm trying to. We're supposed to cross the Adair 327 degree radial at two thousand and then climb to three thousand. But we haven't even got Adair tuned in."

"Coffee 13, Kaycee Center. Squawk ident."

Sammy flipped the ident switch.

"Coffee 13," responded Kaycee Center, "I have you twenty miles south of course. Say altitude, DME, and radial off Adair Vortac."

"Here, you fly it, Sammy. I got the radios," blurted C. R. " . . . Stand by one, Kaycee. We're at two thousand."

"American Six Zero, this is Kaycee Center, turn right immediately to 180 degrees. Repeat, turn right immediately to 180. Conflicting traffic. Acknowledge," shouted the center controller. "Coffee 13, turn right 330 immediately. Climb immediately to three thousand."

Sammy racked the Sabreliner into a steep, right climbing turn.

"Yeeooow," shouted C. R. as the silhouette of a jumbo jet filled the windshield and passed just off the left wing. "He . . . he . . . that airline weenie! What's that dumbo jumbo doing at our altitude?"

"Coffee 13, are you experiencing problems?" asked Kaycee Center.

"Ah, hummph—minimum nav aids. Declaring minimum nav aids, Center," blustered C. R. "Also, aren't you stacking 'em up a little close tonight? I could see the, er, eyeballs of the stews in that jumbo."

A pause.

"One Three, turn left two-five zero, radar vectors to Dixon," replied the voice of a different controller. "The American captain says he's going to file a near-miss. Request you telephone Kaycee Center and ask for the watch supervisor after landing at your destination.

Now, Sir, contact Kaycee Center on . . . "

●

"Cease and desist your worry, my young fledgling," soothed C. R., heaving his leather hang-up bag up the crew bus step. "Leave it to yours truly to handle that little explanation about the dumbo. After all, he was at our altitude, not we at his."

Sammy looked as if his name had just been placed at the top of the next RIF board agenda.

"I don't know, Boss, we should've been . . . gosh, look who's waiting in the base ops lobby. It's the commander."

The Dauntless Duo pulled their gear off the crew bus and, with C. R. leading the way, marched into the lobby.

"Major Terror, I know you must have some kind of an excuse for that dumb stunt you pulled. And I want to hear it before I convene an administrative R and C board," snarled the colonel.

"Ah, well, Sir—actually, if the radar controllers had exhibited the same kind of 'can do' attitude as that possessed by yours truly, there would never have been a near-miss to begin with. Why — "

"Near-miss?" cried the Colonel. "What's this about a near-miss?"

C. R.'s chin dropped to upper chest level as he glanced at Suffering Sam.

"Ab—ub—ah, er, hee, hee. Just a joke, Sir," mumbled C. R. feebly. "What were you talking about?"

"Major," blared the colonel, "I'm talking about how you got into such a hurry to depart that you left your passenger sitting in the terminal at your last stop."

Sammy thought C. R. was going to faint. He instinctively grabbed his aircraft commander by one arm.

"That's right, Sam," said the colonel, "and when his mind clears, tell him to report to my office first thing Monday morning—and not in his flight suit because he won't be flying again for a long time."

The red-faced colonel turned briskly and marched out the door.

Finally, C. R. spoke.

"Sammy m'lad, I've flown the line for many a year, and I've seen many a commander come and go because their aircrews didn't make their takeoff times. But this is a new twist. Just doesn't seem fair."

"How's that, Sir?" asked Sammy.

"I go to the trouble to take off early, and now I take the blame even though on-time departure is the name of the game. Irony, m'boy, sheer irony," moaned C. R.

"Sorry, Boss," whispered Sammy. "Anything I can do to help?"

"Er, yes, m'lad," C. R. relented, glancing slyly at his young copilot, "call Kaycee Center and ask for the watch supervisor. I'd do it myself, but I have a party to make at the VFW Club."

Quick Stoppers

Caught in the Act

During preflight inspection of a UH-1N, the helicopter mechanic discovered an oil leak in the combining gearbox compartment. After removing access panels and wiping off excess oil, he checked the area with the engines running, but there was no further trace of the leak. Engines were shut down, panels replaced, and number two engine restarted. As he accomplished a routine post engine-start leak check, he spotted an oil leak near the oil cooler blower. Without informing the pilots, the mechanic attempted to wipe the oil with a rag. But the oil cooler blower sucked the rag from his hand and promptly gobbled it up, damaging the blower. Investigators pointed out that there was no communication or coordination between the mechanic and the pilots concerning the mechanic's intended action.

The unit to which the helicopter is assigned no longer uses rags to wipe up oil leaks in the combining gearbox on "N" model Hueys while engines are running.

Split Flaps

As a T-39 crew lowered flaps to 100 percent for an instrument approach, the aircraft suddenly rolled to the right. The pilot halted flap extension at 30 percent and applied substantial left aileron and rudder to maintain level flight. To eliminate the control problem, the pilot returned the flaps to the full up position. With normal control restored, the pilot returned to home station and flew a no-flap approach and landing. Post flight inspection of the flap drive mechanism revealed a failed flap interconnect flex cable.

Beware of split-flap malfunctions. If undetected or uncorrected, they can roll a T-39 into a flight attitude offering little room for recovery. T-39 pilots should keep this little piece of information in mind. Unlike MAC's larger airlifters, there are no flap assymetry detection or protection devices to warn the pilot or automatically halt assymetrical flaps.

A Case of the Bends?

A KC-135 crew performed their 10,000-foot pressurization check during climbout and discovered that cabin pressure, instead of increasing, was still at sea level. Readjustments were made to the cabin rate control, but as the aircraft climbed through flight level 260, the cabin pressure increased to 10,000 feet. The aircraft commander directed all crew members on 100 percent oxygen and initiated the pressurization malfunction checklist while continuing to flight level 330. When manual pressurization was selected, cabin pressure shot up to 19,000 feet. In spite of checklist reaccomplishment and further attempts to isolate the pressurization malfunction, cabin pressure rose to 24,000 feet, even with the manual control in the full closed position. As troubleshooting continued, the auxiliary pilot in the jump seat complained of pains in his upper arm. The aircraft commander initiated descent to 10,000 feet, requested clearance to a nearby base, and established communications with a flight surgeon through the command post. Although symptoms of decompression sickness disappeared as the aircraft reached 10,000 feet, the crew member was hospitalized for observation.

Strange Place for Ice

Mention of aircraft ice normally conjures up visions of silvery wings covered with great gobs of clear or rime incrustations which make airplanes fly like anvils.

But it was a little ice tucked away in a strange place that recently hassled a C-130 crew trying to land.

After the landing gear was extended, cockpit indications disclosed an unsafe left main gear. Visual inspection confirmed the gear was not fully extended. Employing emergency gear extension procedures, crew members removed bolts and nuts connecting the vertical torque shaft universal joint to the retracting gear adapter so the gear could free fall to the fully extended position. As a precaution, the gear was chained in place. The landing was completed without further complication. Post flight inspection revealed that an iced-up jack screw prevented normal gear operation. When the aircraft was placed on jacks and the ice was removed, the gear worked as advertised.

Qs

Traffic Sign Sheared

Aircraft dipping too low on final occasionally play touch-and-go with treetops, approach lights, and the like; but one T-39 recently struck something different—a roadway traffic sign. Following a local training mission at two nearby civilian airports, the Sabreliner headed home. But as it approached the runway, the aircraft dipped low on its glide path and struck a traffic sign approximately 350 feet short of the threshold. Two brake pucks were ripped from the right main gear.

After touchdown, the pilot applied brakes but the left main blew out and the aircraft ran off the left side of the runway. Its right wing struck an arresting cable stanchion. The old illusion trick has claimed many a victim, many of whom are lured into low, flat approaches to short runways by the prospect of landing an airplane not equipped with reverse thrust or anti-skid brakes.

Navy Snags

During takeoff from a Navy base, the nose gear on a C-141 tripped an arresting gear cable. The cable whipped up and ripped away the aircraft's VHF antenna. The aircraft commander stated that the takeoff roll seemed normal.

A similar incident at another Navy base also claimed a small piece of a C-141—its number one VHF antenna.

Navy bases don't hold a monopoly on arresting cables. Where there are fighters, whether at Air Force, Navy, Marine, or NATO bases, be on the lookout for arresting cables. It may not be a bad idea to plan takeoffs and landings beyond those potential snags.

Two Engine Fowl

Chances are that few MAC pilots who drive four-engine machinery will find themselves flying a real two-engine approach. Such predicaments are usually diabolic fabrications of mentally deranged simulator instructors. But for a C-5 crew shooting a touch and go, the unusual happened recently.

Just as the aircraft broke out on top of an overcast following a touch and go, the crew felt an abrupt impact followed by moderate to severe vibrations from the left side of the aircraft. Suspecting engine malfunctions, the pilot throttled both number one and two engines to idle, which quietened the trembling turbofans for the moment. The pilot declared an emergency and subsequently flew a two-engine approach and landed his ailing aircraft. The cause of the sudden vibes was a massive ingestion of large migratory fowl.

Any Pasture Will Do

One of the advantages sling wing drivers have over their fixed wing counterparts is the ability to set an ailing aircraft down almost anywhere. That's precisely what occurred recently when a CH-53 started coming unglued. Approximately ten minutes after liftoff the cyclic began to oscillate laterally, driving the helicopter into unwanted and unpleasant left and right banks. The pilot requested vectors to a radar final but before he could begin the approach, the utility hydraulic pressure dropped below 2,000 p.s.i. and the transformer rectifier failed. The pilot declared an emergency and requested descent into VFR conditions. Not long after starting down, the first stage hydraulic pressure began to drop. With first stage hydraulic pressure still on the decline, the big chopper broke out of the overcast at 600 feet—at which time the pilot spotted an open field dead ahead and set his ailing machine down into it.

after deadline . . .

THE USAF HAZARD REPORT ISN'T THE ONLY WAY to let people know about a bad situation. A new FAA program provides for a waiver of disciplinary action when a hazard is promptly reported. Areas of greatest interest are near-midairs, ATC facilities, pilot/controller communication, and unsafe airport conditions. If you see a potential hazard or experience an incident caused by one, contact your flying safety officer within 72 hours (to meet the "prompt reporting" criterion), and he'll take it from there. Immunity is not extended to persons involved in accidents, gross misconduct, reckless operation, criminal acts, or malfeasance in job performance.

THE MAC FLYING SAFETY WRITING CONTEST appears to have been a big success. We received lots of words and music from you "real world" aviators. Contest winners will be announced in the July issue. If you were a little late getting your tale to us, we'll enter it for you in next year's contest.

NEXT MONTH --

* "The Aviator's Handbook" is sure to aid the FNG in becoming an "old head."

* What are MAC pilots made of? Read "The Graduate."

* If you've ever felt the pressure of holding down a full time desk job and simultaneously maintaining flying proficiency, you'll benefit from a perspective and a moral in "A Matter of Priorities."

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976-665-669/9

Touch 'n Go